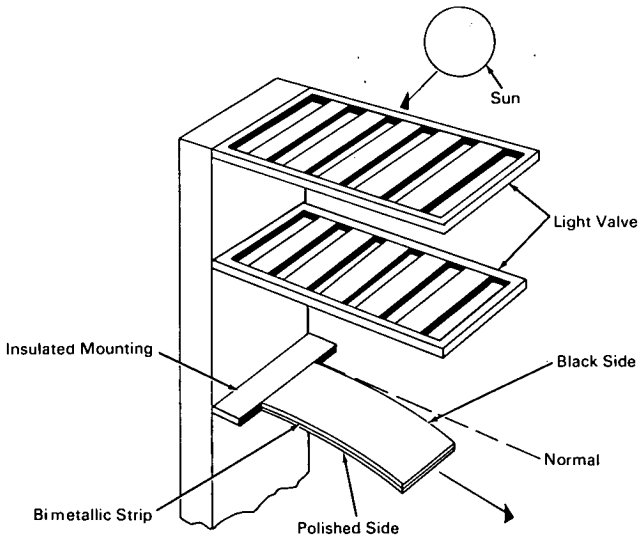
NASA TECH BRIEF

Simple Control Device Senses Solar Position



The problem: Many systems are affected by the presence of solar radiation. In those systems adversely affected by such radiation beyond a certain level, it is necessary to adjust or shield equipment as the relative position of the sun changes. The amount of heat and light energy received by an area is a function of the angle of incidence of the sun's rays on that area. A simple and reliable device is needed to provide control actuations as a function of solar incidence.

The solution: A light valve that controls the amount of solar radiation incident on a specially prepared bimetallic strip. The axis of the light valve is oriented in the direction of normal solar motion as it relates to the system or equipment involved. Curvature of the bimetallic strip is a function of angle of solar incidence and may be used to actuate control mechanisms.

How it's done: The light valve consists of two sections, resembling venetian blinds, with transverse slots and slats of equal width. The two sections are stacked with axes parallel and are separated so as to provide 25% transmission of radiation at normal incidence. Transmission typically varies linearly from 0% to 50% with small deviations from normal incidence. The bimetallic strip is prepared with one black side and one highly polished side. The black, high-absorptivity side is faced toward the light valve and the polished, low-emissivity side is faced away, the whole being thermally insulated from its mounting. Angular change in position of the bimetallic strip is a function of the characteristics of the strip and light valve, the position of the sun, and time.

The important characteristics of the particular configuration used are its gain and time constant which are approximately 1/6 and 2500 seconds, respectively,

(continued overleaf)

with the solar intensity at earth distance from the sun. Although time constant is fairly easily understood, the concept of gain may need some clarification. Gain is the ratio of the steady state change in the angular movement at the tip of the bimetallic strip to the change in sun/actuator angle.

Notes:

1. Sensitivity and dynamic range can be adjusted by varying the slot-to-slat ratio and the separation distance between the two venetian blind sections.
2. Characteristics such as gain and time constant can be adjusted by the selection of different sensitivity bimetallic elements or merely changing their physical size.
3. This device may find application where temperatures must be maintained under varying amounts of incident sunlight, such as greenhouses or modern office buildings with their vast expanses of single pane glass. It should be pointed out, however, that the device described was designed to operate in a vacuum; thermal isolation of the bimetallic strip is critical to its operation. Convection losses caused by a surrounding atmosphere may be significant and should be investigated further if this type of application is planned.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B65-10061

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C.. 20546.

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